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AUTHOR Stevens, Lawrence
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ABSTRACT

This unit contains activities dealing with wastes, the Greenhouse Effect, ozone depletion, energy, deforestation, and species extinction. Each section has a text to explain the issues and a crossword puzzle to reinforce the vocabulary. There are diagrams with questions that can be used as handouts or as transparency masters. (EH)

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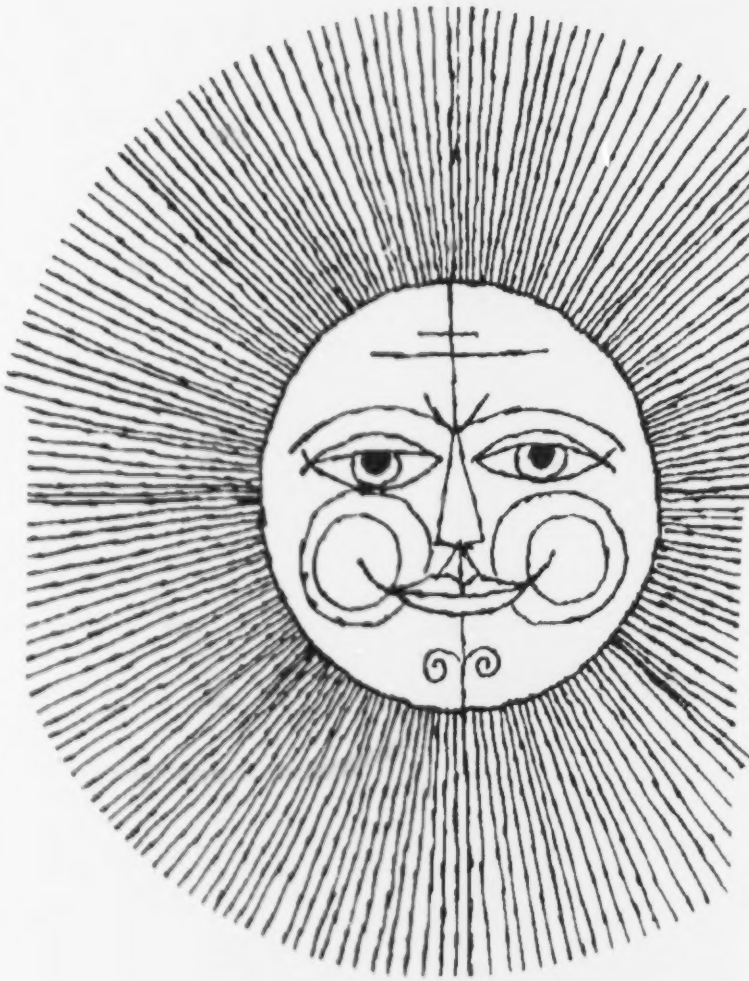
ED 402 248

Creative Activities for Teaching About the Environment



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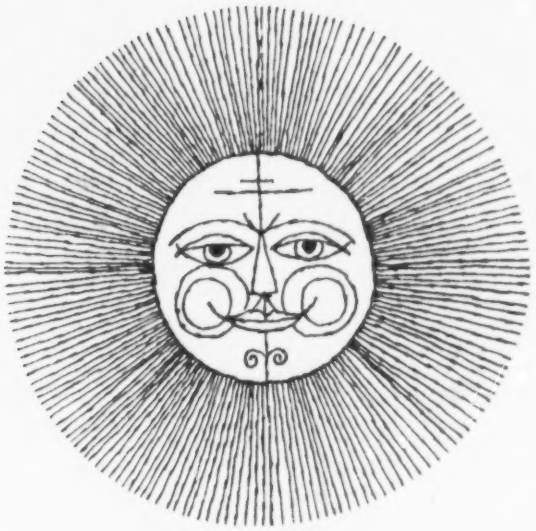
Environment Teacher's Guide

Creative Activities for Teaching About the Environment

SS600



This unit contains a variety activities dealing with wastes, the Greenhouse Effect, ozone depletion, energy, deforestation and species extinction. Each section has a text to explain the issues and a crossword to reinforce the vocabulary. There are several diagrams with questions which can be used as handouts or as transparency masters.

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Environment Answers

Wastes

Solid Waste Text

1. 850 million pounds. 2. High consumption. 3. Recycle. 4. Answers will vary.

Toxic Wastes Text

1. Cosmetic reasons. 2. Find way into water. 3. Answers will vary. 4. Answers will vary.

Crossword

Across: 1. herbicide 4. aluminum 5. lead 6. pesticide 7. dump 10. waste 12. incinerate 14. solid 16. recycle 17. landfill 19. paper.

Down: 1. heavy 2. contaminate 3. water 8. ocean 9. glass 11. toxic 13. garbage 15. drinking 18. disposal.

Recycling

What Makes Up Garbage: 1 paper, yard 2, metals 3, food 4, plastics 5, wood 6, rubber 7, textiles 8.

What Is Recyclable: 1. R 2. R,T 3. R 4. R 5. T 6. R 7. R 8. R 9. R 10. R 11. R, T 12. T 13. T 14. R 15. R.

Solutions

Answers will vary.

Graph

Answers will vary.

Greenhouse Effect

Text

1. Reflected back into space. 2. Absorbs heat. 3. The heating of the Earth's atmosphere. 4. Answers will vary. 5. Answers will vary.

Crossword

Across: 2. coal 3. ice 5. atmosphere 9. coastal 13. reflected 15. space 16. oceans 18. oil 19. solar.

Down: 1. gasses 4. carbon dioxide 6. temperature 7. sun 8. fahrenheit 10. fossils 11. greenhouse 12. climate 14. CO2 17. polar.

Solutions

Answers will vary

CO2 Cycle Diagram

1. Decrease 2. Increase 3. Decrease 4. Decrease.

Problems

1. increase by 5 units 2. decrease by 10 units 3. decrease by 25 4. decrease by 25 5. 2 degree increase 6. a net increase of 100 7. 1 degree increase.

Deforestation

Species Extinction Text

1. Provide food, oxygen, medicines, fertilize soil. 2. Pollinate plants, fertilize soil, medicines. 3. Eliminate useful species of plants and animals and alter climate. 4. May destroy food supplies.

Rain Forests Text

1. Turn to desert. 2. Opportunities for people. 3. 100 years. 4. Medicines.

Decision Making

Answers will vary.

Crossword

Across: 2. endangered 9. pollinate 12. trees 14. deforestation 15. medicines 18. earthworm 20. insects.

Down: 1. carbon dioxide 3. extinct 4. acre 5. weather 6. nitrogen 7. species 8. food chain 10. oxygen 11. Brazil 13. soils 16. desert 17. cattle 19. rain.

Energy

Text

1. Pollute the air. 2. Active converts solar power into electricity directly. 3. Does not run out. 4. Solar, wind and hydroelectric.

Crossword

Across: 2. voltaic 5. fossil 6. energy 7. coal 8. wind 12. natural 13. radioactive 14. passive 16. electricity 18. generator 19. wood 20. methane.

Down: 1. photosynthesis 3. oil 4. hydroelectric 9. nuclear 10. active 11. solar 14. petroleum 15. steam 17. carbon.

Sun Power Diagram

1. 47.5% 2. 35% 3. 17.5% 4. Decrease.

Ozone Depletion

Text

1. Stratosphere. 2. Protect against ultraviolet rays. 3. Skin cancer. 4. Cold weather.

Crossword

Across: 2. CFC 7. depletion 8. styrofoam 11. ozone 13. holes 14. polar 15. methane 16. carbon 17. cancer.

Down: 1. stratosphere 3. chlorofluorocarbons 4. ultraviolet 5. refrigeration 6. solar 9. atmosphere 10. aerosol 12. air.

Diagram/Questions

1. chlorofluorocarbons. 2. Reduce the destructive chemicals. 3. Increased disease.

General Environment

Great Earth Test

1. B 2. A 3. A 4. A 5. A 6. C 7. A 8. D 9. A 10. D 11. A 12. C 13. B 14. C 15. B 16. C 17. B 18. A 19. D 20. C.

Environmental Questionnaire

Answers will vary.

Crossword

Across: 1. biomass 5. Greenhouse 9. ecology 15. landfill 16. PCB 17. dioxide 19. methane 21. carbon 22. ecosystem 23. species.

Down: 2. ozone 3. atmosphere 4. deforestation 5. gridlock 6. EPA 7. smog 8. fossil 10. organic 11. recycle 12. nuclear 13. Gaia 14. CF. 18. energy 20. toxic.

Vocabulary Test

1. U 2. B 3. W 4. R 5. C 6. A 7. G 8. E 9. D 10. O 11. Y 12. I 13. H 14. F 15. J 16. S 17. V 18. N 19. Q 20. P 21. K 22. L 23. M 24. T 25. X.

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Solid Wastes Text

Each year Americans throw away 16 billion disposable diapers and 220 million tires. The amount of solid wastes thrown away each day averages 3.4 pounds for each person each day. This does not include industrial, mining and farm wastes or junked cars.

The United States has a serious problem in finding places to put all this waste. 80% of the solid wastes now are dumped into 6,000 landfills or garbage dumps. These dumps are rapidly filling up. In the past five years 3,000 dumps have been closed. By 1993 another 2,000 will close.

Some large cities close to the ocean such as New York City dump their garbage in the ocean increasing ocean pollution. Many of the garbage landfills are dangerous because the rotting garbage produces methane gas which burns and contains toxic chemicals which can leak into the ground water.

Solid waste is a problem in the industrialized countries North America, Europe and Japan. Production of a large variety of consumer goods and high average incomes that enable people to buy the goods create a garbage problem. 37% of the garbage in the United States is paper and most of the paper is packaging materials.

Much of the garbage can be recycled or used again. Japan recycles more than 50% of its trash, Western Europe around 30%. Only 10% of the wastes in the United States is recycled. Paper, glass bottles, aluminum and other metals can be used to make more paper, glass and metals.

Wastes can also be burned to generate electricity. West Germany uses 30% of its unrecycled wastes to produce electricity. The United States uses 6%.

Questions

1. If there are 250 million people in the United States, how much garbage is produced each day?

2. Why is solid waste a problem in industrialized countries?

3. What will the United States eventually have to do to find a place for its garbage?

4. Why do you think that the United States recycles less of its garbage than other countries?

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Toxic Wastes Text

People use chemicals to improve the quality of their lives. Chemicals are used to make plastics, pesticides and polyester. In the forty years from 1945 to 1985 chemical production increased from 6.7 million tons to 102 million tons. There are 70,000 different chemicals in everyday use and 500 to 1,000 are added each year.

The problem with chemicals is that many are poisonous. Herbicides and pesticides which are used to kill weeds and insect pests are also dangerous to humans. There are 400,000 to 2 million poisonings each year. Some herbicides and pesticides are used to increase the production of the food we eat. Most, however, are used to make fruit and vegetables look better by protecting them from insect damage.

There are two problems with pesticides and herbicides. Some of the poisons remain as residues on the fruits and are eaten by people, but most of the poison is washed into the ground where it eventually finds its way to underground water supplies which many people use for drinking water.

Another problem with toxic wastes is what to do with chemicals that are no longer needed. In the past they have been dumped on the ground where they have contaminated water supplies. The government now requires that they be placed in special toxic waste dumps or incinerated. This is very expensive. It costs $240 a ton to store toxic waste in a landfill dump and $500 to $1,200 a ton to burn the waste.

The water supplies of many communities have been contaminated by toxic wastes. 175 chemicals have been found in water supplies. 32 of these chemicals are known to cause cancer. They are called carcinogens. Chemicals also cause birth defects.

Heavy metals can also damage a person's health. Mercury, lead and zinc attack the human nervous system, cadmium can cause kidney damage, nickel and beryllium attack the lungs and antimony can cause heart disease.

The government is faced with the problem of cleaning up toxic wastes. The chemicals can be found almost anywhere. Service stations, for example, with leaky underground tanks can let lead seep into water supplies. Power lines have transformers that contain a dangerous chemical. Water wells in farming areas are often contaminated with pesticides. Houses and communities with lead water pipes also run the risk of large amounts of lead in the drinking water.

In some instances, entire communities have become contaminated. A subdivision in New York had to be destroyed when it was discovered that it was built on an old toxic waste dump. An entire town in Missouri had to be destroyed when it was discovered that a dangerous chemical had been sprayed on the streets.

The government controls the disposal of those toxics that are known to be dangerous. Many people, however, eliminate the dangerous chemicals they have around home by washing them down the drain or throwing them in the garbage. In addition, we don't know whether most of the chemicals in use are dangerous to people. They have not been tested.

Questions

1. Why are herbicides and pesticides used on crops?

2. What is the problem with herbicides and pesticides?

3. Why do you suppose it is more expensive to burn toxics than to store them in a landfill?

4. Why do you suppose that most chemicals have not been tested to see if they are harmful to humans?

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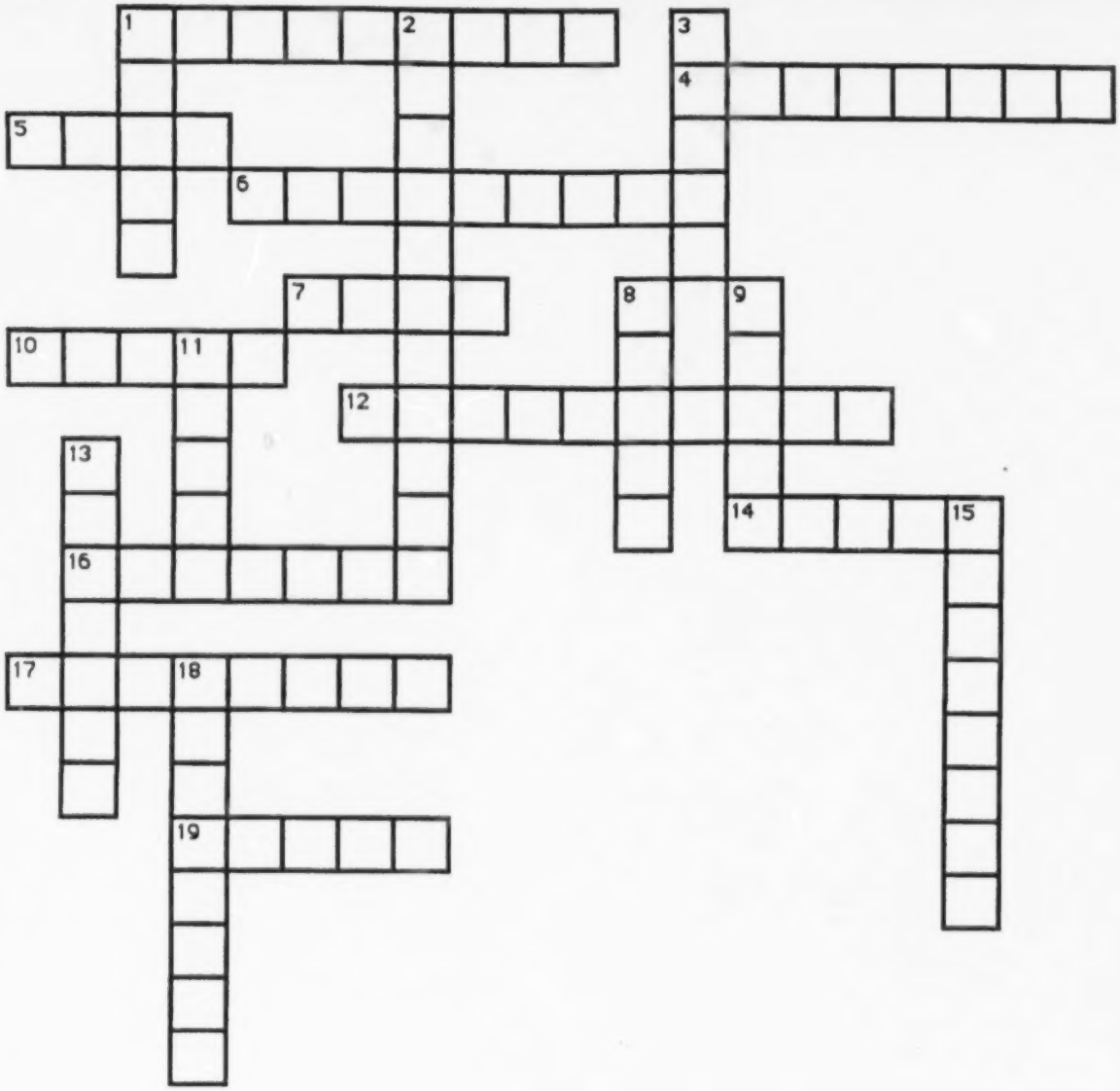
Wastes Crossword



Across

1. A chemical that kills plants.
4. A metal that can be recycled.
5. Water pipes can be made of this.
6. A chemical that kills insects.
7. Where garbage goes.
10. The U.S. produces more of this than any other country.
12. To burn garbage.
14. Most waste is _____.
16. To reuse.
17. A nice name for a garbage dump.
19. Most garbage is made up of _____.

Down

1. _____ metals are dangerous.
2. What chemicals and heavy metals can do to water.
3. What people need to live.
8. Where some big cities dump their garbage.
9. It can be recycled.
11. Poisonous.
13. Wastes.
15. You don't want your _____ water contaminated.
18. Get rid of it.

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What Makes Up Garbage?

What do you think makes up garbage? Below is a list of things commonly put into garbage. Which do you think makes up the largest amount of your garbage? Place a 1 next to it. Place a 2 next to what you think is found in the second largest amount, etc.

_____food

_____glass

_____metals

_____paper

_____plastics

_____rubber

_____textiles

_____wood

_____yard wastes

What is Recyclable? What is toxic?

Below is a list of items. Which items can be recycled? Put an **R** next to the items you think can be recycled. Which do you think are toxic? Put a **T** next to the toxic items.

1._____ newspapers

2._____ plastic containers

3._____ cardboard boxes

4._____ food packages

5._____ old paint

6._____ used motor oil

7._____ aluminum cans

8._____ magazines

9._____ glass bottles

10._____ food scraps

11._____ car batteries

12._____ paint thinner

13._____ insect spray

14._____ rubber tires

15._____ old clothing

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Solutions

Below are some solutions to the problem of waste. If you had to pick only one of these solutions, which would it be?

1. Raise the price of garbage collection.

2. Households and businesses should be charged according to how much garbage they produce.

3. Require households to separate garbage into recyclable and non-recyclable items.

4. Raise the reward for recycling.

5. Increase the variety of containers that can be returned for recycling.

6. Use non-cyclable garbage to generate electricity.

Make A Law–The Problem With Plastics

Plastics do not rot like organic materials such as food and paper. It is not advisable to burn them because they can give off poisonous fumes.

Plastics are difficult to recycle because different resins are used to make plastic containers. The plastics must be separated according to the resin used to make the plastic. Some common resins are PET, PVC and HDPE. The way plastic containers are made today there is no way of telling what resin is used by looking at the container.

Plastics, once they are separated out according to the resin, can be ground into pellets and remolded into fence posts, carpeting and anything else that needs to be weatherproof.

Can you think of a solution to this problem?

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Directions

Design a garbage truck that will separate recyclables such as glass, aluminum, and paper.

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Wastes Graph

Percentage of Garbage

Below is a chart that shows what percentage each type of waste makes up of our total amount of garbage.

paper	37.1
glass	.97
metals	9.6
plastics	7.2
rubber and leather	2.5
textiles	2.1
wood	3.8
food wastes	8.1
yard wastes	17.9
other wastes	1.9

Directions

Make a bar graph showing the proportions of the different types of garbage.

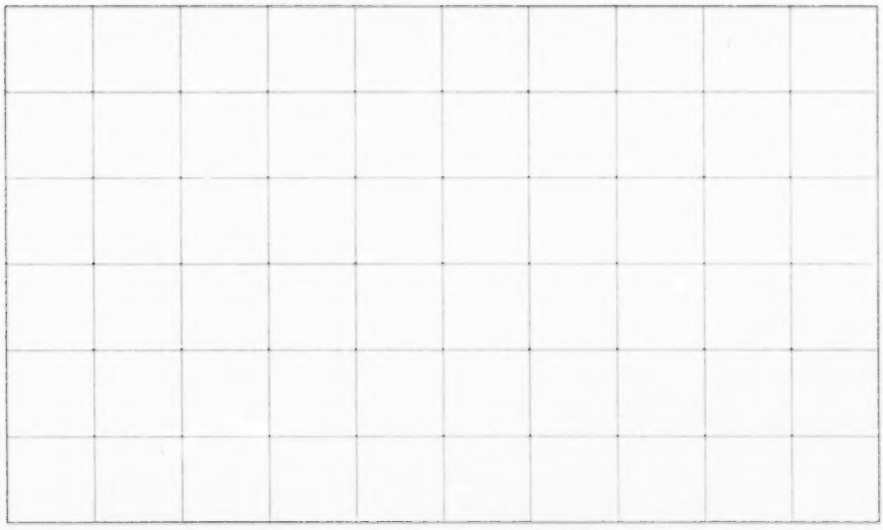
Recycling

Most of our garbage can be recycled but very little of it is. We produce 3.43 pounds of garbage per person per day. Only .35 pounds is recycled.

What Can Be Recycled?

Paper can be turned into new paper and cardboard products.
Glass can be melted and shaped into new products. It can also be ground up and used for roads.
Metals can be melted and reused.
Plastics, if separated by type, can be remolded.
Textiles can be reused.
Rubber can be burned for electrical energy.
Wood, **food** and **yard wastes** can be used to make fertilizer, compost or used to produce methane gas for energy.

The **Environmental Defense Fund** has details on local programs and a free recycling brochure. Toll-free hotline: (800) 225-5333.



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Greenhouse Effect

Text

The Greenhouse Effect is heating up the Earth's atmosphere. The Earth receives its energy from the Sun. The air which surrounds the Earth helps regulate the energy the Sun provides. It deflects many of the harmful rays of the Sun. Much of the radiation that strikes Earth is reflected back into space through the atmosphere. This enables the Earth to keep a moderate temperature over much of its surface.

However, the Earth's atmosphere is changing. There is an increase in the amount of carbon dioxide (CO_2) in the air. The carbon dioxide comes from the burning of fossil fuels such as oil and coal. Oil and coal are used to fuel electric generating plants. Oil is also used to power cars. As power plants and cars have increased over the last 80 years, the amount of carbon dioxide has also increased. The increase of carbon dioxide in the Earth's atmosphere prevents the heat of the Sun's radiation from escaping back into space.

There are other gases escaping into the atmosphere which also increase the temperature of the Earth. Methane, which comes from rotting organic material, chlorofluorocarbons which are used in air conditioners and the making of plastics, nitrous oxides and ozone which are also produced by the burning of fossil fuels also contribute the Greenhouse Effect.

It is expected at current levels of increase that the amount of gases will double over the next 50 years. If the amount does double the temperature of the Earth will increase by 2.7 to 8.1 degrees Fahrenheit by 2030 to 2050.

Scientists estimate that the biggest increase in temperatures will come in the temperate and polar areas. The increase in temperature will have an effect on water supplies, rainfall, winds, ocean currents and climate. It is expected that the wheat growing areas of North America and Russia will become warmer. Increased evaporation of water during the summer will reduce the amount of wheat grown. It is expected that tropical areas will receive less rainfall. The changing climate may also produce severe storms in areas that did not have them before.

An increase in temperature at the polar ice caps will cause the ice to melt and the oceans to rise. Some scientists estimate that the oceans will rise 4.7 to 7 feet by the year 2100. This will flood large areas of the world including large parts of Texas and Florida. Hundreds of millions of people who live along coasts will be forced to move. This will have a disastrous effect upon Asia where not only large numbers of people live in coastal lowlands, but a large amount of the rice crop will be flooded.

Even if people drastically change their habits now, the Greenhouse Effect will continue for years into the future and change the climate.

Questions

1. What normally happens to most of the sun's energy when it strikes earth?

2. How does carbon dioxide affect the sun's energy?

3. What is the Greenhouse Effect?

4. Why do you suppose scientists cannot predict accurately the increase in temperature?

5. What possible results will the Greenhouse Effect have?

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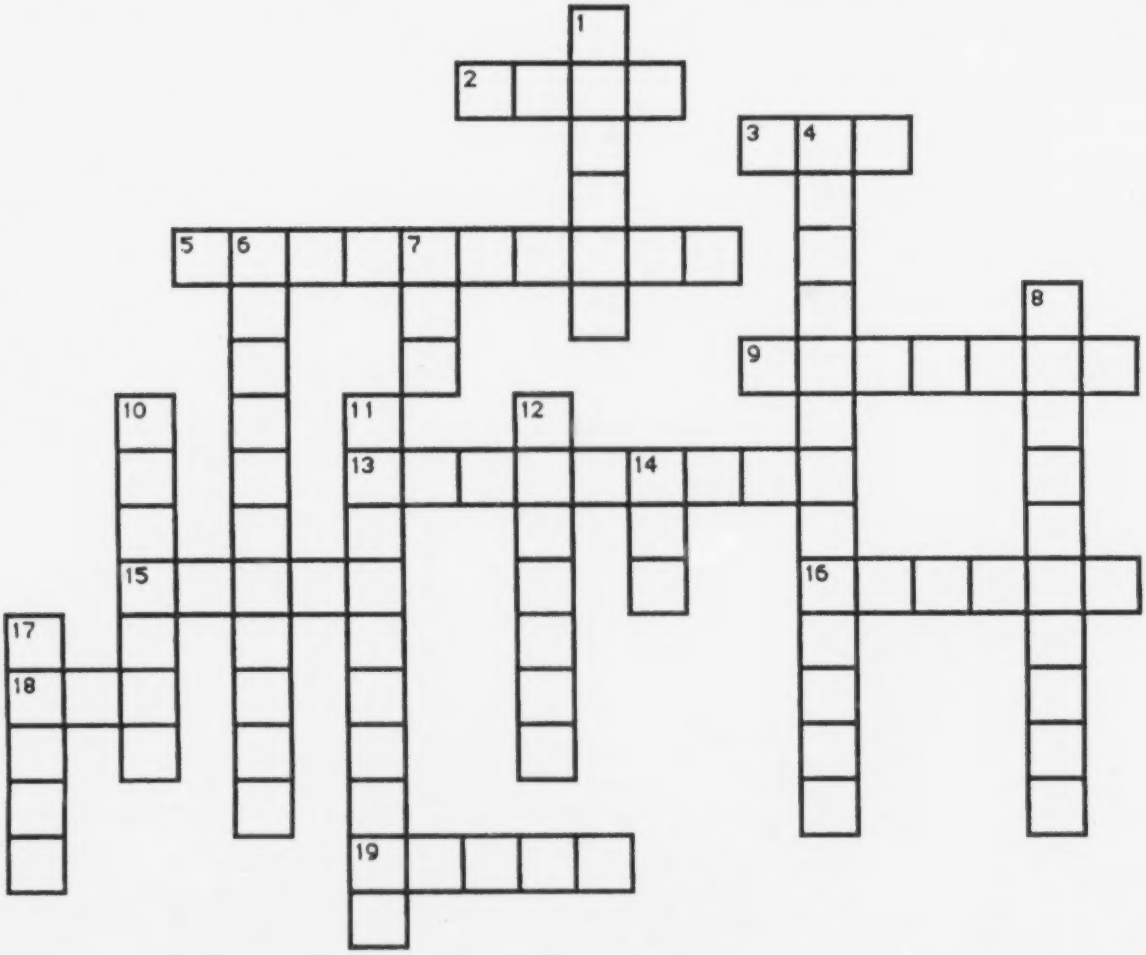
Greenhouse Effect Crossword



Across

2. Solid, black fossil fuel.
3. What will melt at the poles.
5. A layer of air surrounding Earth.
9 Regions that may be flooded.
13. Given off as in an image in the mirror.
15. Where radiation normally goes.
16. What might rise.
18. Liquid fossil fuel.
19. Of the sun.

Down

1. What makes up the atmosphere.
4. CO_2
6. Measures heat.
7. Where solar power comes from.
8. A scale for measuring temperature.
10. Where some fuel comes from.
11. Nickname for the heating of the Earth's air.
12. Weather over a period of time.
14. A chemical abbreviation for a gas.
17. The _____ ice caps.

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Solutions

Below is a list of ways to reduce the amount of greenhouse gases going into the atmosphere. Select three that you think are best. Tell why.

Write your answer below.

1. Place a special tax on carbon-dioxide emissions. This would include an extra tax on gasoline or cars.

2. Increase funding for research on alternative energy sources.

3. Launch a mammoth international tree planting program.

4. Provide financial aid to poor countries to build high efficiency power plants.

5. Develop techniques for recovering the methane that is given off by landfills and feedlots.

6. Ration the amount of gasoline sold.

7. Force people to use less energy by increasing the price for people who use more heat and electricity than necessary.

8. Limit the number of cars sold.

9. Build more nuclear power plants.

10. Spend more money on rapid transit systems so that people do not have to use cars.

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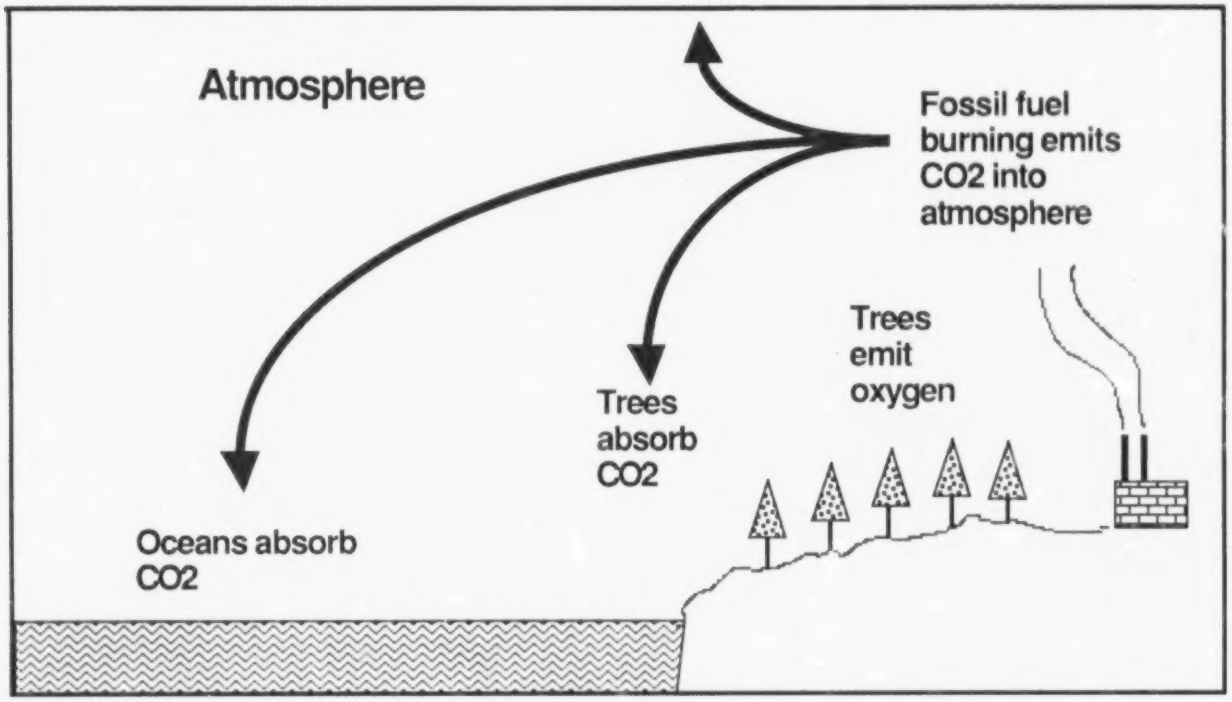
Greenhouse Effect — CO2 Cycle



The burning of fossil fuels (oil, gasoline and coal) increases the amount of CO2 in the atmosphere. Cars use gasoline and power plants that produce electricity use oil and coal.

Trees breathe in CO2 and release oxygen. The ocean also absorbs carbon dioxide. The rest is in the atmosphere where it absorbs heat radiated from earth.

1. What will happen to the CO2 in the atmosphere if more trees are planted?

2. What will happen to the CO2 if more trees are cut down?

3. What will happen to the CO2 if cars use less gasoline?

4. What will happen to the CO2 if we use less electricity?

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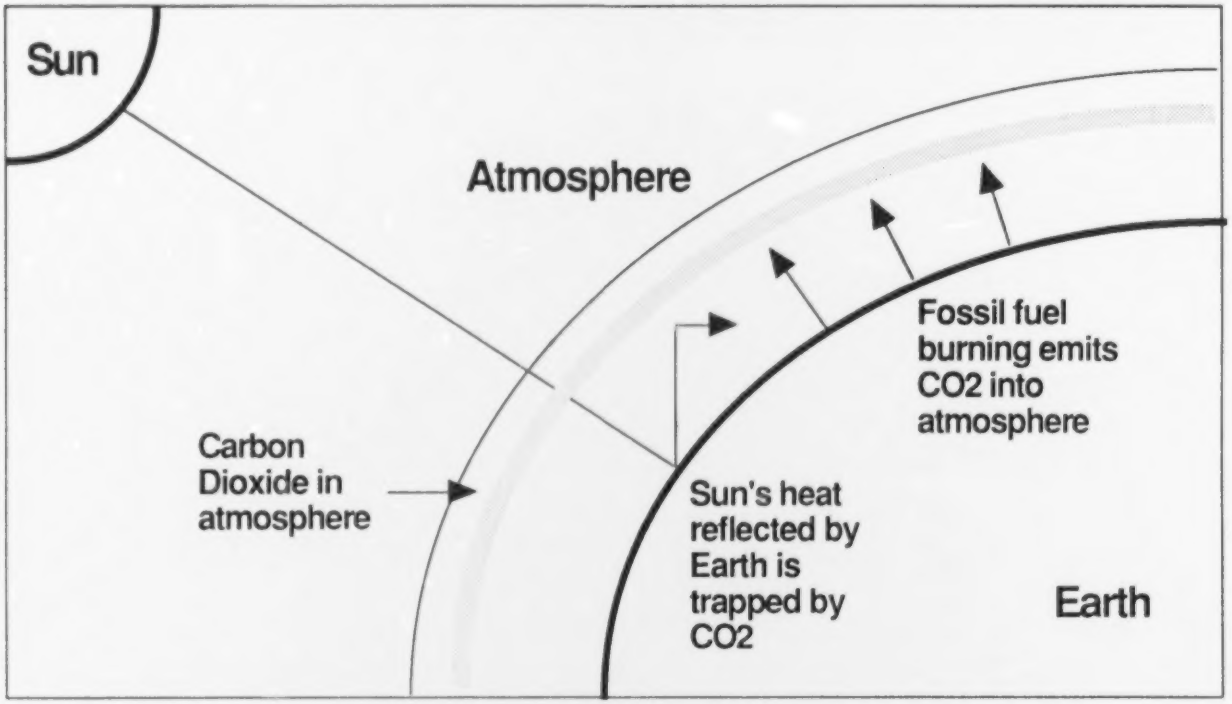
Greenhouse Effect Problems



In a year 100 units of CO_2 are emitted by cars and power plants. The cars produce 50 units of CO_2 and power plants 50 units. 50 units are absorbed by the oceans and 10 units by the trees. 50 units of CO_2 in the atmosphere will increase the temperature by 1/2 of a degree. All of these numbers are for a one year period. The amount of carbon dioxide in the atmosphere is accumulative.

What will happen next year to the amount of CO_2 in the air, if.....

1. one half of the trees are cut down?

2. the number of trees is doubled?

3. cars use half as much fuel?

4. we use half as much electrical power?

Over the next five years what will happen...

5. to the temperature if nothing else changes?

6. to the amount of carbon dioxide in the air if the number of trees is immediately doubled and cars immediately become 20% more fuel efficient?

7. to the temperature in five years if the above conditions happen?

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Deforestation Species Extinction Text

There are 1.5 million species of animals on earth that we know about and about 300,000 species of plants. It is estimated that 3 to 8 million species of plants have yet to be discovered. The plants and animals, including humans, depend upon each other to live. Animals depend on plants and other animals for food. This is called the food chain. The elimination of one animal in a food chain may lead to the starvation of other animals.

There are other ways in which plants and animals depend upon one another. Trees, for example, help produce oxygen, use up carbon dioxide and help clean dust and pollution from the air. This enables animals, including humans, to breathe.

Earthworms and ants help fertilize the soil by bringing it to the surface where oxygen can get into it. Plants also help fertilize the soil by putting nitrogen into it. This enables plants to grow. Bees and other insects pollinate plants enabling them to reproduce. While people may not like worms, ants and bees, they are important to our existence.

Plants and animals also provide many useful things to humans in addition to food. Leeches are providing information about anesthetics, manatees about blood clotting, a periwinkle plant has chemicals that help fight leukemia and the mayapple has chemicals that can be used to fight cancer, measles and herpes.

Many animal and plant species live in tropical rain forests that are being destroyed. In Latin America it is expected that 52% of the forests will be destroyed by the year 2000. If this happens, 15% of the plant species, or 13,600, will become extinct. This will mean a loss of food for many animal species and a loss of many possible medicines and other uses of plants that have yet to be discovered.

As species of plants are destroyed, humans have come to depend on just a few species of plants for most of their food. Just 30 crops provide 95% of the Earth's food and only 8 crops provide 75%. The earth's 5 billion people depend on maize, wheat, rice, beans, peanuts and soybeans for most of their food. In North America, wheat is the basic food. Only four varieties of wheat are grown and one variety accounts for 75% of the wheat grown. Depending on one species of wheat is dangerous. If a disease attacks the crop, a large part of the food supply may be destroyed.

Questions

1. How do plants help humans?

2. How do insects and small animals help humans?

3. What is the danger of destroying the rain forests?

4. What is the danger of relying upon just a few species for food?

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Deforestation

Rain Forest Text

Throughout the world tropical rain forests are being destroyed at a rapid rate. Brazil, which has the largest rain forest, is giving land to settlers who cut down the trees. Brazil has a large population which lives along the coast of Brazil. Many of these people are poor and live in slums. The government of Brazil is trying to move them into the rain forest so they can have a better opportunity in life. Other countries throughout the tropical belt of the world have the same problem. They are attempting to develop opportunities for their citizens by destroying the rain forests.

The soil of the rain forests is not very fertile. It wears out after a few years of farming. Farmers then move on and cut down more trees. The land that is left behind turns to desert. It takes many years for the forest to recover.

In some places the forests are being destroyed to raise cattle which is sold to U.S. fast food restaurants. In other places the trees are cut for their timber. Rain forests are made up of hardwood trees which are used in making furniture.

Rain forests provide homes for many types of plant species. A typical rain forest has 600 different types of trees. A normal forest has only 60 types of trees. Many plants have never been identified.

Rain forests also provide homes for many types of animal and insect species. When the rain forests are cut down 40% of the animal and insect species will disappear. Rain forests are cut down at the rate of 3,000 acres an hour. In 100 years all of the rain forests in the world would be destroyed if this continues.

Plant and animal species in the forests provide many things for people. They provide chemicals that cure diseases. Quinine, for example, comes from a tropical tree. It helps reduce the effects of malaria. An extremely poisonous South American tree frog produces poisons that can be very helpful in reducing heart disease. The venom of a Brazilian snake is used to develop a drug to control high blood pressure.

Scientists continue to make new discoveries from rare tropical plants. An African plant, kenaf, may be used in the future for paper. It produces five times as much pulp as the trees normally cut for paper. Loss of plants and animals in the rain forest will close off many possible discoveries of useful things.

Questions

1. What will happen to the rain forest after it is cut down?

2. Why are rain forests being cut down?

3. How long will it take for the rain forest to disappear?

4. What are the useful things the rain forest provides people?

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Deforestation Decision Making

Who is at fault for the destruction of the earth–the rich countries or the poor?

Directions

Industrialized countries such as the United States and developing countries in the Third World disagree over who is most responsible for the environmental damage of the Earth.

Read both sides. Whom do you think is most at fault for the destruction of the Earth's atmosphere?

United States and Industrialized Countries

1. The United States has the strongest environmental protection laws. Third World countries such as Brazil have almost no laws to protect the environment. One of the most polluted cities in the world is in Brazil.

2. Brazil is cutting down the Amazon rain forest at a rapid rate. The destruction of the rain forest destroys many valuable plant and animal species and may help heat the Earth's atmosphere.

3. Third World countries such as Brazil allow too many people to be born. They do not practice family planning.

4. Many of the environmental problems in the Third World are caused by overpopulation which in turn causes the destruction of trees and the creation of deserts which, in turn, results in starvation.

5. Brazil and other Third World countries are trying to industrialize without any regard to protecting the environment.

Brazil and Third World Countries

1. Brazil is large and has a growing population that lives in crowded slums in big cities located along the coast. Moving people to the rain forest area is providing them with opportunity.

2. The United States encouraged people to settle the frontier 100 years ago. Many animal species were destroyed. Brazil has the right to do the same thing to provide opportunity for its people.

3. The United States encourages the destruction of the rain forest. They buy the cattle that are raised in deforested land for fast food restaurants. 55 acres of forest land are destroyed to produce one-quarterpound of beef.

4. The United States and industrialized countries use most of the world's fossil fuel energy and produce most of the gases that are the cause of the Earth's warming.

5. The United States and industrialized countries produce the chemicals that are destroying the ozone layer. It is the life style of citizens of the United States and industrialized countries that is creating most of the environmental problems in the world.

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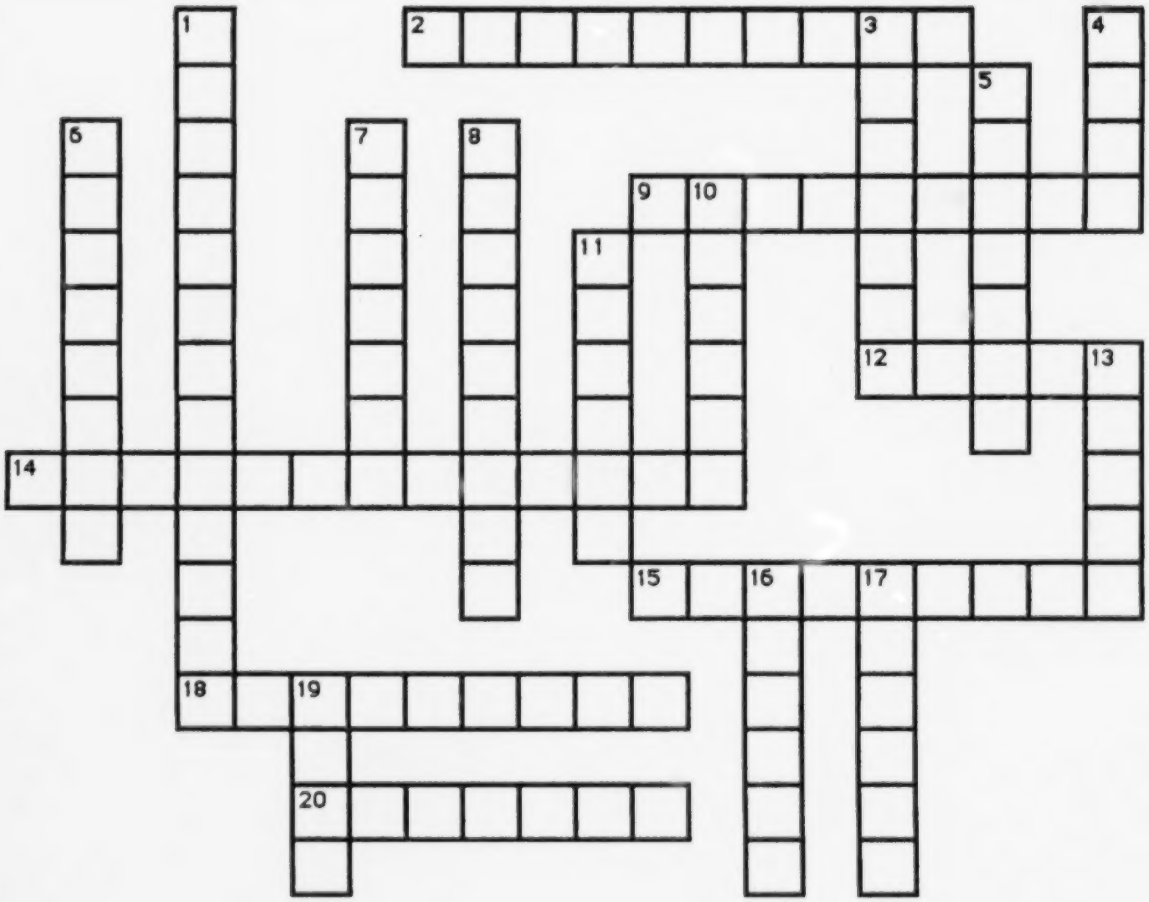
Deforestation Crossword



Across

2. Almost extinct. They are in danger.
9. Fertilize plants.
12. What makes up a rain forest.
14. Cutting down trees.
15. Helpful things derived from plants.
18. It tunnels in the earth.
20. They help pollinate plants.

Down

1. A gas absorbed by trees.
3. No longer exists. The species is dead.
4. A unit of land measurement in area.
5. Rain forests produce their own.
6. A chemical that fertilizes soil.
7. Types of animals and plants.
8. Relationship of plants and animals. (2 words).
10. A gas given off by plants and trees.
11. Where the Amazon is.
13. Different types of dirt.
16. What the rain forest will turn into if the trees are cut down.
17. Beef.
19. The _____ forest.

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Energy

Text

People need energy to cook their food, to heat and light their houses, to make things and for transportation. Most of the energy we use comes from the sun.

People in industrialized countries use fossil fuel for their energy. Fossil fuels are produced by plants that died millions of years ago. Coal and oil are the most common fossil fuels. When they are burned they release carbon into the atmosphere which combines with oxygen to produce carbon dioxide. Natural gas is another form of fossil fuel. It burns cleaner and is less polluting than coal or oil.

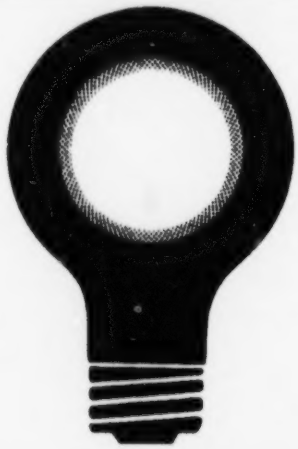
Fossil fuels are a non-renewable energy source. Once they are used, they are gone forever. It is predicted that oil will be exhausted early in the 21st Century.

The most common form of energy that we use is electricity. Electricity is produced by heating water, turning it to steam and the steam powers a generator that produces electricity. Coal, oil and nuclear power can be used to heat the water.

Electricity can also be produced by falling water. This is called hydroelectric power. The water is dammed and then channeled through pipes to generators that are turned by the force of the falling water. This type of electricity can only be produced where there are mountains and rivers.

There are other forms of energy. Sun power is used. The sun's energy can be used to heat water and air inside a house. This is called passive solar power. It can also be used to produce electricity through solar voltaic cells. This is active solar power. Solar voltaic cells are very expensive and this is not practical.

In windy areas, windmills can be used to turn generators and produce electricity. Neither



wind or solar power produce any air pollution.

Nuclear power is also used in many industrial countries. Radioactive material which produces heat is used to create steam which turns electrical generators. No pollution is released into the air. However, the radioactive material once it is used is still radioactive and dangerous. It is difficult to dispose of.

Another fuel source is the use of biomass-material. This is a form of fossil fuel. Rotting plants and other organic matter can produce methane gas which can be burned just as natural gas can. While there is plenty of garbage and plant material to provide fuel, biomass generation has the disadvantage of other fossil fuels–it pollutes the air.

Questions

1. What is the chief disadvantage of fossil fuels?

2. What is the difference between passive and active solar energy?

3. What are the advantages of biomass fuel over coal and oil?

4. What sources of power are restricted in use to particular times of day or places?

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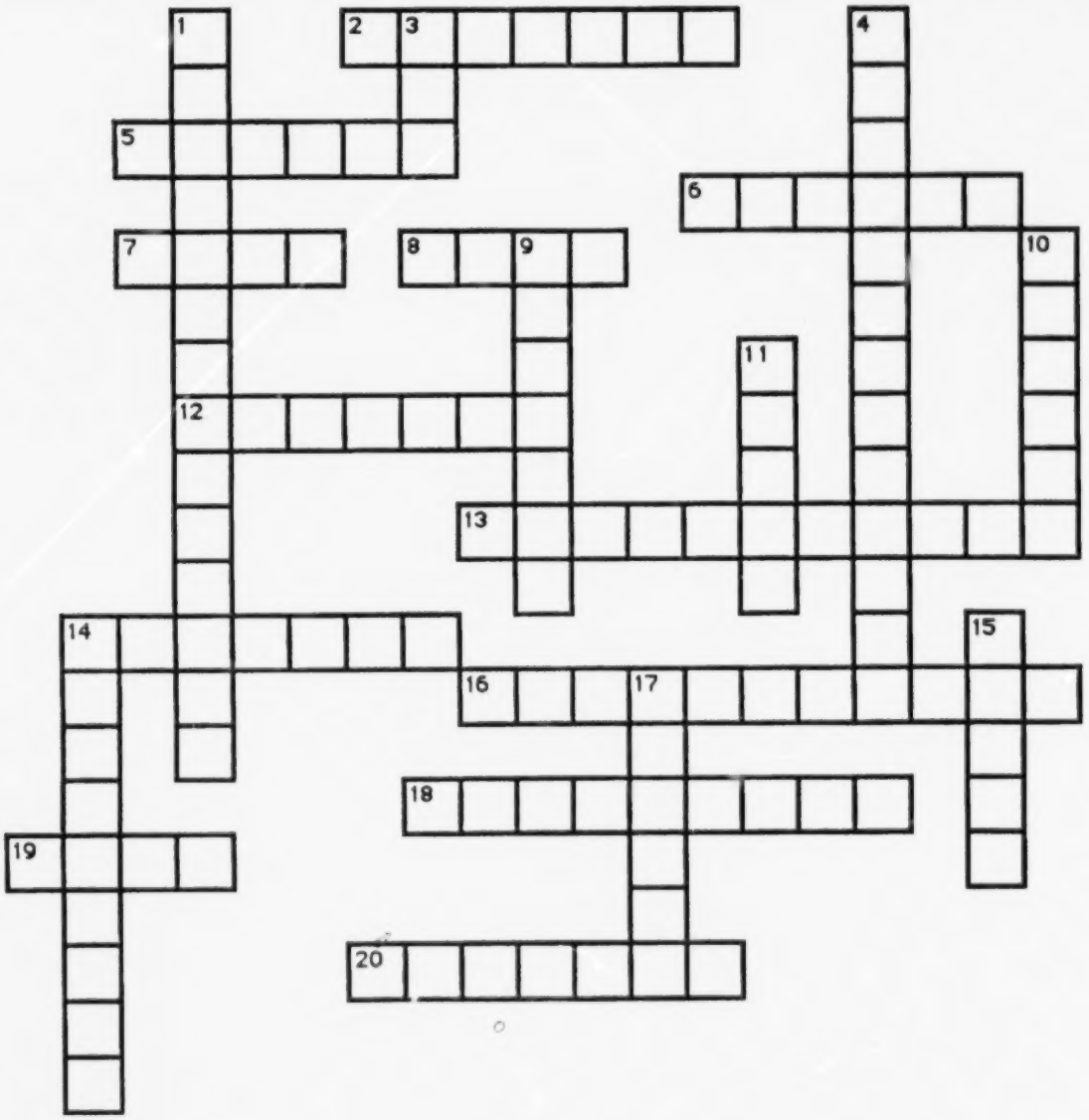
Energy Crossword



Across

2. Cells that convert the sun's energy to electricity directly.
5. Coal and oil are _____ fuels.
6. What it takes to make things move.
7. Black and solid.
8. Air currents.
12. A clean burning gas.
13. What nuclear power is.
14. Using the sun's energy to heat air and water.
16. It is needed for lights.
18. Produces electricity.
19. What Third World countries use for energy.
20. A gas produced by rotting organic material.

Down

1. Converts sunlight to energy.
3. Black and liquid.
4. Falling water produces this _____ power.
9. Produced by atoms giving off _____ energy.
10. The direct conversion of sunlight to electricity.
11. Sun power.
14. Oil.
15. Hot vapor used to drive electrical generators.
17. What is given off when fossil fuels are burned.

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Sources of Energy Evaluation

Evaluate the sources of energy below. Use this scale. 3=good, 2=average, 1=poor.

Type	Solar	Wind	Nuclear	Fossil	Hydro	Biomass
Effect on air quality						
Produces no harmful wastes						
Use anywhere						
Use anytime						
Does not cost much to build						
Uses a renewable fuel						
Other						

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The Toast Isn't Done

Narrator: Early in the morning in the Crandall household Mother is getting breakfast ready while reading the morning paper. The son enters.

Mother: You look awful!

Son: I stayed up late last night doing homework.

Mother: Horsefeathers! I heard the stereo blasting away.

Son: I have to have some sounds to make the evening go faster.

Mother: The toast is getting cold.

Susie: I'll be right there. I'm drying my hair. This blow dryer just doesn't put out enough heat to dry my hair any faster.

Mother: Is your father out of the shower yet?

Sister: He's out. I hear his razor.

Mother: Did you see the paper about the nuclear reactor, Son?

Son: Naw.

Mother: Didn't you read the paper?

Son: Yeah. I saw this Camaro for sale. Good price and loaded. 352 cubic inch engine.

Mother: Well, this nuclear reactor nearly blew up. Could have hurt thousands, I guess. I think it's just terrible.

Son: Can I turn on the TV?

Mother: Sure. Maybe they have the latest news on the reactor.

Narrator: The sister comes into the kitchen.

Sister: Good morning.

Mother: Sit down. Here's your toast and a poached egg.

Sister: Oh, did you try the new egg poacher that Dad got you?

Mother: Yes. It works just fine.

Son: Could I have some more juice?

Mother: You'll have to get some out. Use the electric can opener.

Son: Aw, a guy can't get any service around here.

Narrator: Father enters.

Father: Service! Before you know it you'll be asking for an electric wheel chair. Mom, would you put some toast in?

Son: You're always on my case lately.

Father: You were supposed to cut the lawn.

Son: The mower doesn't work.

Father: It probably needs a new motor.

Sister: Speaking of motors, my electric toothbrush doesn't work right.

Mother: Fred, do you want some bacon?

Father: Sure. That new electric slicer is a real dandy.

Mother: Did you hear about that nuclear power plant nearly blowing up?

Father: Yeah. A shame. They should shut them all down.

Son: The man on the TV says we can't afford to shut them down. They might have a brownout if they do.

Father: Those darn government fellows. You can't trust them to tell the truth.

Sister: Oh, wow! I nearly forgot to charge up my calculator.

Father: All that talk about brownouts is scare talk.

Sister: Isn't there an empty outlet anywhere in the house?

Mother: I think you can disconnect the blender. Son, would you clean off the plates into the garbage disposal?

Father: And put the rest of the garbage in the compactor and turn on the dishwasher.

Mother: What's this coming on? A special bulletin. Oh, I hope that nothing bad has happened.

TV Announcer: The President has asked that the American people voluntarily cut their energy consumption. The Nuclear Regulatory Commission is asking all nuclear plants cut back to 70% of production while their safety is being checked.

Mother: They should just turn them off. I don't think that God would really want us to be using uranium.

Father: We can't even afford an air conditioner.

Mother: But if we did have one, we would turn it off. Anything to help.

Father: Sure. Where's my toast.

Mother: Let me see. Oh, Oh. Susie took out the toaster plug. You know, Fred, we're just going to have to get some more outlets in this kitchen.

Father: Well, I have to go. I'll do without the toast. Do you want the TV set left on?

Mother: Yes, I want to see the game shows.

The End

Questions

1. How many electrical appliances does the family use?

2. How many of the appliances can they get along without?

3. Do they waste electricity?

4. If so, in what way?

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Energy Checklist

Directions

Below is a list of home appliances and how many kilowatt-hours they use in a year. How many of these do you have in your home? Which could you do without?

Food preparation	**KWh**
blender	1
broiler	85
carving knife	8
coffee maker	106
dishwasher	363
frying pan	100
mixer	2
microwave oven	190
range with oven	1,175
range with self-clean oven	1,205
sandwich grill	33
toaster	39
trash compactor	50
waffle iron	20
garbage disposal	7
Food Preservation	
freezer–manual defrost (15-21 cubic feet)	1,320
freezer–automatic defrost (15-21 cubic feet)	1,985
refrigerator/freezer	
10-15 cu.ft. manual defrost	700
16-18 cu. ft. auto defrost	1,795
20 cu. ft. auto defrost	1,895
Laundry	
clothes dryer	993
iron	60
washing machine	103
water heater	4,219
water heater (quick recovery)	4,811

Comfort	
air cleaner	216
air-conditioner (per room)	860
bed covering	147
dehumidifier	377
fan (attic)	291
fan (ceiling)	43
fan (window)	170
fan (rollaway)	138
heater (portable)	176
heating pad	10
humidifier	163
Health & Beauty	
hair dryer	14
shaver	.5
tooth brush	2
Home Entertainment	
radio	86
radio/record player	109
color TV (solid state)	320
color TV (tube type)	528
BW TV (solid state)	100
BW TV (tube type)	220
House	
clock	17
sewing machine	11
vacuum cleaner	46

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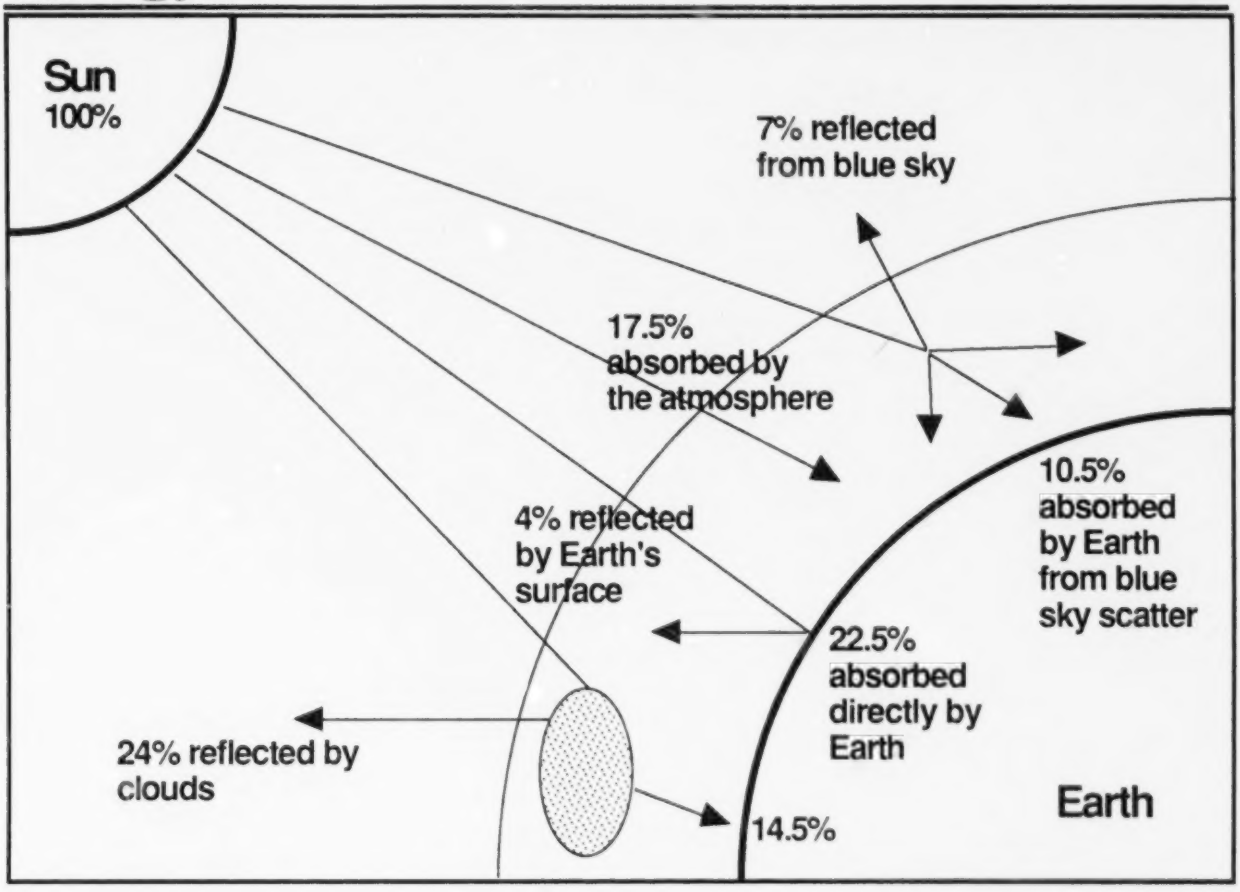

Sunlight provides energy for the Earth. The rays of the sun are converted by plants to energy through a process called photosynthesis.

Plants that died millions of years ago provide us with fossil fuels today. Fossil fuels are coal, oil and natural gas.

Plants produce food which provide animal life with energy. They also provide fiber and medicines. Plant material can also be used to provide energy. Wood can be burned and rotting plant material gives off methane gas which can be burned.

Questions

1. How much sunlight is absorbed by Earth?

2. How much is reflected into space?

3. How much sunlight is absorbed by the atmosphere?

4. If clouds increased what would happen to the amount of sunlight absorbed by Earth?

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Ozone Depletion

Text

A new environmental concern arose in the 1980's. It was ozone depletion. Ozone is found in the part of the atmosphere known as the stratosphere. The stratosphere extends from about 15 kilometers to 50 kilometers above the earth at the equator.

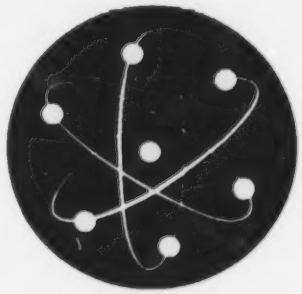
If the ozone layer was compressed at earth's pressure it would only be a layer one-eighth of an inch thick. It is a very important layer. It is the part of the earth's atmosphere that prevents the harmful ultraviolet rays of the sun from striking earth.

The ultraviolet rays of the sun are dangerous to human health. They can cause skin cancer and suppression of the immune response system. The immune response system protects people from many diseases.

Destruction of the ozone layer can also have an effect on other forms of life. It can harm small land and water animals. This can, in turn, deprive larger animals of food and destroy food chains.

The cause of the ozone depletion comes from several sources. The best known are CFC's. CFC's are chlorofluorocarbons which are used as propellants in aerosol cans, refrigerants, solvents in making computer parts and making styrofoam. Other gases also combine to destroy ozone. Carbon dioxide, methane and nitrous oxide also are destructive. Carbon dioxide is produced by burning fossil fuels and methane is produced by rotting organic material. These gases also help produce the Greenhouse Effect or the warming of the earth.

The cold air over the North and South Poles cause the CFC molecules to break down into chlorine monoxide. The chlorine monoxide stimulated by sunlight destroys ozone at a very rapid rate.



A 1 percent depletion in the ozone layer increases ultraviolet radiation by 2 percent and adds to a 4 to 5 percent risk of skin cancer. The ozone layer over the Northern Hemisphere has been depleted by 6 percent since 1969 and by as much as 2.3 percent over much of the United States.

Scientists still debate how much of a danger the disappearance of the ozone layer is. The ozone layer changes naturally. Scientists debate how much of the change in the ozone layer is caused by nature and by man-made chemicals.

Questions

1. Where is the ozone layer located?

2. What does the ozone layer do?

3. What diseases are caused by ultraviolet radiation?

4. Why do holes in the ozone layer appear over the North and South Poles?

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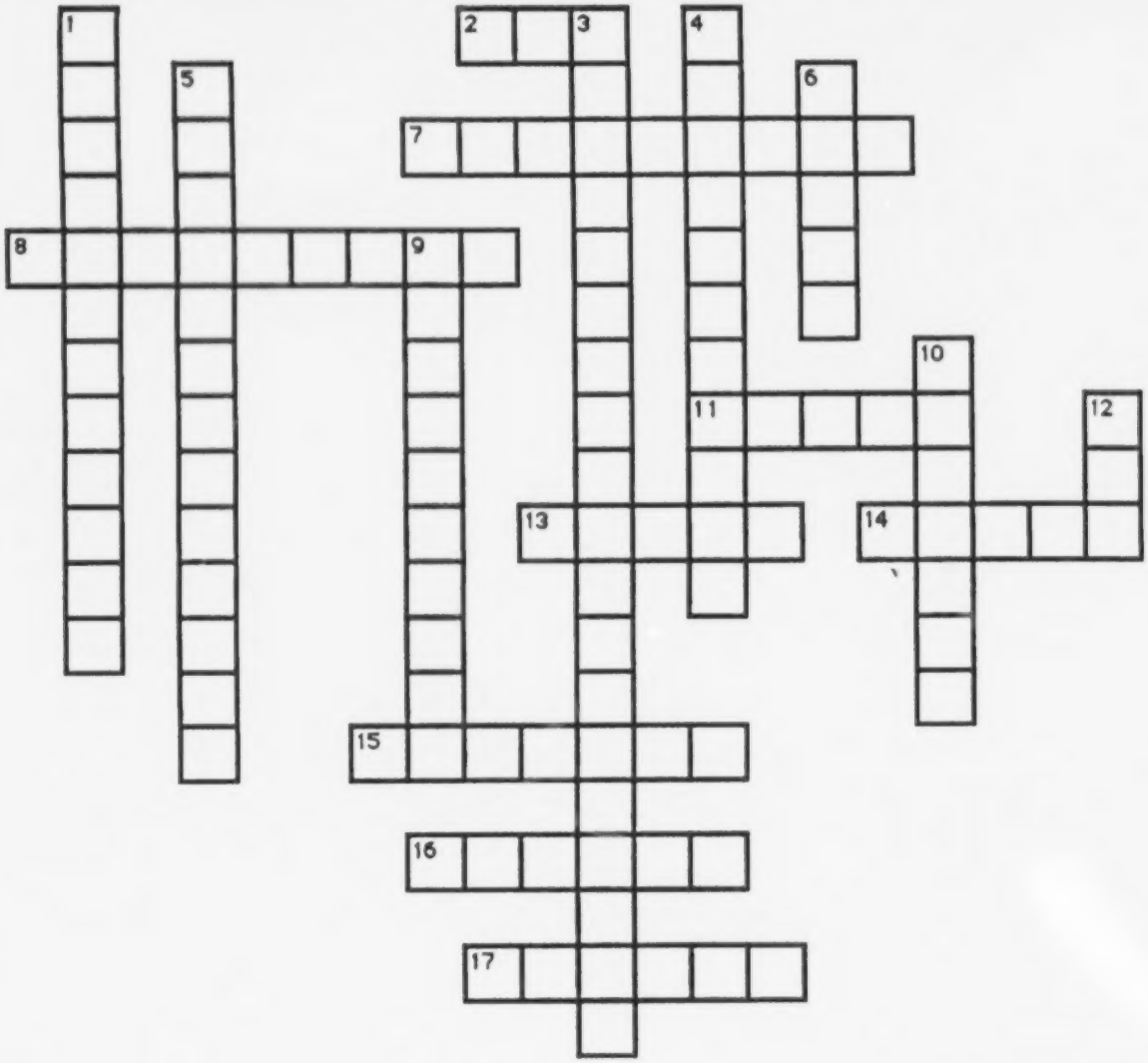
Ozone Depletion Crossword



Across

2. Chlorofluorocarbon.
7. The using up of something.
8. Plastic made with CFC's.
11. A protective layer in the atmosphere.
13. Scientists have found these in the ozone layer.
14. Regions where holes in the ozone have been found.
15. A gas emitted by rotting organic material.
16. _____ dioxide.
17. A skin disease caused by ultraviolet radiation.

Down

1. Where the ozone layer is.
3. Chemicals destructive to the ozone.
4. Harmful rays of the sun.
5. Where CFC's are used.
6. The sun's power.
9. Surrounds the earth.
10. CFC's are used to propel these sprays.
12. Atmosphere.

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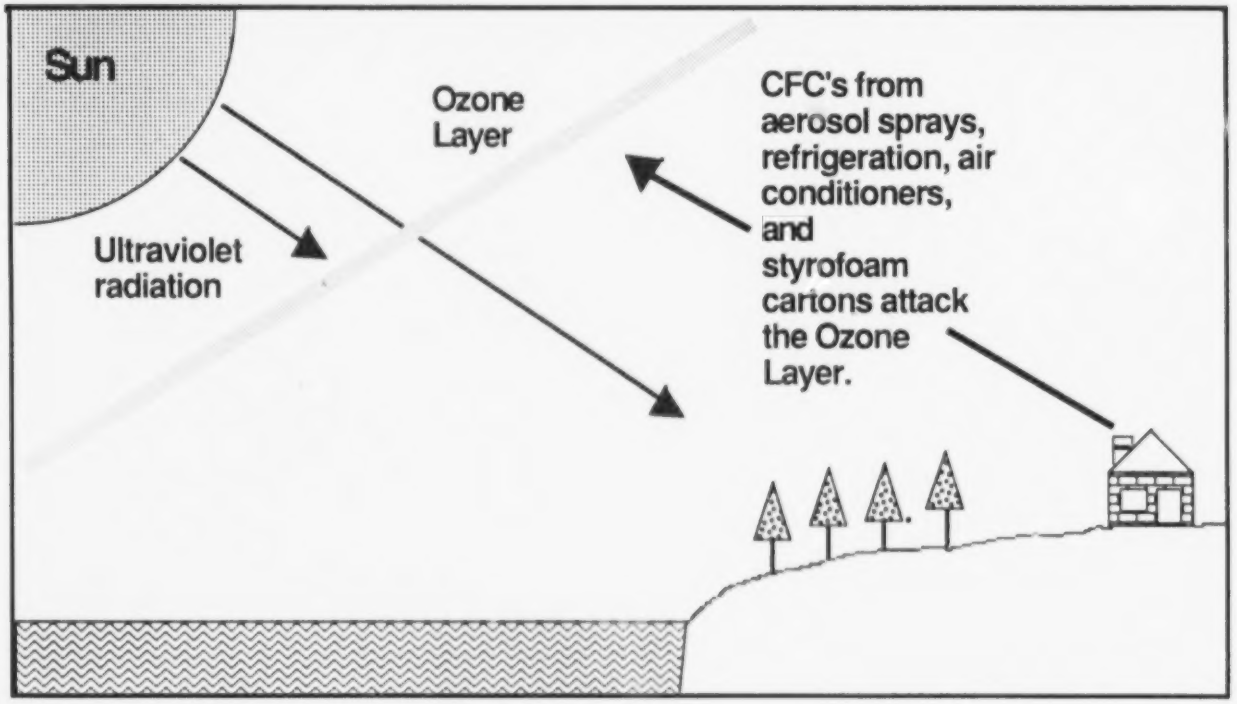
Ozone Depletion Diagram


Sun
Ozone Layer
CFC's from aerosol sprays, refrigeration, air conditioners, and styrofoam cartons attack the Ozone Layer.
Ultraviolet radiation

The atmosphere provides the Earth with a protective covering. It contains the gases which sustain life. It also regulates the Earth's temperature. It protects the Earth from space debris (meteorites) which burn up before they reach the Earth.

The ozone layer protects life on Earth from harmful ultraviolet rays of the sun. The ozone layer is found in the part of the atmosphere called the stratosphere.

Ultraviolet radiation can cause skin cancer in humans and alter ecosystems of other life forms.

The ozone layer can be destroyed by certain chemicals that are emitted into the atmosphere. These chemicals interacting with temperature and sunlight can destroy ozone molecules.

Questions

1. What things can destroy the ozone layer?

2. What can be done to reduce attacks upon the ozone layer?

3. What will be the consequences of ozone depletion?

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Great Earth Test

1. Disappearence of the ozone layer will have what effect?
   - A. Decrease the temperature of the Earth.
   - B. Increase the amount of skin cancer.
   - C. Increase rainfall in the tropics.
   - D. Increase snowfall in mountain areas.

2. The Greenhouse Effect will have what effect?
   - A. Raise the level of the oceans.
   - B. Decrease temperatures.
   - C. Increase snowfall.
   - D. Increase the production of wheat in North America.

3. What is not an effect of acid rain?
   - A. Increases the growth of trees.
   - B. Destroys animal life in lakes and rivers.
   - C. Destroys trees.
   - D. Activates heavy metals.

4. Destruction of rain forests in the tropics can affect us in what way?
   - A. Increase the amount of carbon dioxide in the air.
   - B. Increase the amount of rainfall.
   - C. Decrease the Earth's temperature.
   - D. Provide more food.

5. How much garbage is thrown away by businesses and residences each day for each person?
   - A. 3.5 pounds
   - B. 25 pounds
   - C. 10.5 pounds
   - D. 1 pound

6. What causes acid rain?
   - A. Nuclear power plants.
   - B. Hydroelectric power plants.
   - C. Coal and oil fueled power plants.

7. Smog is found over big cities. What causes smog?
   - A. Cars
   - B. Nuclear power plants

8. What agency in the U.S. Government is in charge of protecting the environment?
   - A. USDA
   - B. FICA
   - C. IRS
   - D. EPA

9. The Ozone Layer is being destroyed by the use of what chemical?
   - A. Chlorofluorocarbons
   - B. Nitrous oxides
   - C. Carbon dioxide

10. What is the cause of the Greenhouse Effect?
   - A. Increasing carbon dioxide in the air because of the burning of fossil fuels.
   - B. The disappearance of the ozone layer.
   - C. Rapid destruction of forests.
   - D. Both A and C.
   - E. Both A and B.

11. Fossil fuels cause much of the air pollution. Which is not a fossil fuel?
   - A. Uranium
   - B. Coal
   - C. Oil

12. A non-renewable resource cannot be replaced when it is used. Which resource is non-renewable?
   - A. Wood
   - B. Water
   - C. Oil

13. Most pesticides are used for what purpose?
   - A. Increase crop production.
   - B. Protect crops from insect damage so that the fruit looks better.

14. How many people are there in the world?
   - A. 1 billion
   - B. 3 billion
   - C. 5 billion
   - D. 10 billion

15. What do paper and cardboard come from?
   - A. minerals
   - B. trees
   - C. oil

16. Most of the Earth is covered by water. What percentage of the Earth's surface is water?
   - A. 50%
   - B. 60%
   - C. 70%
   - D. 90%

17. Garbage is made up mostly of paper. What percentage of waste is paper?
   - A. 17%
   - B. 37%
   - C. 57%
   - D. 75%

18. Electricity is produced by generators. What fuels power most generators?
   - A. Coal and oil
   - B. Nuclear power
   - C. Water power

19. Plants and trees have a variety of effects upon humans. Which is not an effect of plants?
   - A. Produce oxygen.
   - B. Reduce the amount of carbon dioxide in the air.
   - C. Provide food.
   - D. Increase the Earth's temperature.

20. About how many known animal species are there?
   - A. 5,000
   - B. 300,000
   - C. 800,000

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Do You Take Care of the Environment?

Directions

Are you environmentally responsible? Below is a personal environmental checklist. Rate yourself. Use the rating scale below in answering the questions.

4 I do it all of the time.
3 I do it most of the time.
2 I do it some of the time.
1 I don't do it very often.
0 I don't do it at all.

If you score 40 to 60, you are a good environmentalist, if you score 20 to 39, you are average, and if you score less than 20, you are part of the problem.

1._____ When outside do you put garbage in a waste can? Do you avoid littering?

2._____ Do you recycle old newspapers and magazines?

3._____ Do you turn off electric lights and appliances when you are not using them?

4._____ Do you turn off the TV when you are not watching it?

5._____ Do you recycle aluminum cans?

6._____ Do you walk or ride a bike on short trips?

7._____ Do you avoid pouring paint thinner, motor oil, household pesticides and chemicals down the storm drain in the gutter?

8._____ Do you recycle glass jars?

9._____ Do you turn the heater down or off at night?

10._____ Do you turn off the water while you are brushing your teeth or washing your hands? (After you soap up your hands or put the toothpaste on the brush.)

11._____ Do you avoid turning on the air conditioner unless you begin to sweat?

12._____ Do you check to see if windows are closed when the heater or air conditioner is on?

13._____ Do you avoid eating hamburgers at fast food restaurants?

14._____ Do you avoid using pesticides around the house or yard?

15._____ Do you take care to turn off the water in the yard or sink when you are not using it?

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Environmental Glossary

atmosphere
The layer of air surrounding the Earth. Protects the Earth from particles and solar rays that would be harmful to life. Also helps control the temperature of the Earth.

biomass
Refers to the total of life on Earth, both plants and animals.

biosphere
Refers to the relationship of plants and animals to the atmosphere that surrounds Earth.

carbon dioxide
A blend of carbon which is burned and oxygen. This gas is responsible for heating the Earth's atmosphere.

chlorofluorocarbons
A chemical that is the cause of the disappearance of the Ozone Layer. The chemical is used to produce styrofoam, in hairsprays, and in air conditioners.

deforestation
Describes the cutting down of the forests of Earth, particularly tropical rain forests which contain a large number of animal and plant species.

desertification
Describes the increasing size of deserts. Deserts can increase because of people and animals destroying plants and trees or because of large amounts of salty water used to irrigate the land.

ecology
A study of the relationship between man and nature.

ecosystem
Describes specific relationships among living things and the environment.

Environmental Protection Agency
An agency of the U.S. government in charge of enforcing environmental protection laws. Known as EPA.

fossil fuel
Coal and oil which provide most of our energy. Fossil fuels also provide most of the air pollution.

Gaia Hypothesis
The idea that Earth is a living system. Life helps create the environment it needs in order to live. Gaia is the ancient Greek word for Mother Earth.

Greenhouse Effect
The heating of the Earth's atmosphere caused by the use of fossil fuels which produce carbon dioxide. The carbon dioxide collects in the atmosphere and prevent the sun's heat from radiating back into space.

gridlock
Traffic congestion caused by cars.

landfill
Where garbage is buried. We are running out of places to put garbage.

methane gas
A gas that is produced by rotting organic material (garbage). It can be used for energy and it helps damage the atmosphere.

nuclear power
Power produced by radioactive elements that give off energy.

organic
Refers to rotting or deteriorating material that was once alive. It is mostly made up of carbons.

ozone layer
A layer of oxygen atoms that have been combined. It protects the Earth from harmful rays of the sun.

PCB's
A common toxic chemical that can pollute water supplies. Stands for polychlorinated biphenyls. Know to cause cancer.

pollution
A general term to describe the damage to the natural environment caused by humans.

population explosion
Describes the rapidly expanding human population.

recycle
The recovery and reusing of waste products.

species
Different types of life.

smog
A form of air pollution produced by cars and factories that burn fossil fuels. The emissions interact with sunlight to form smog.

wastes
What humans throw away after use . They come in the form of garbage (solid wastes), toxic wastes and sewage.

toxic wastes
Wastes that are particularly poisonous to humans. These wastes are chemicals that do not break down naturally and dissolve into the Earth.

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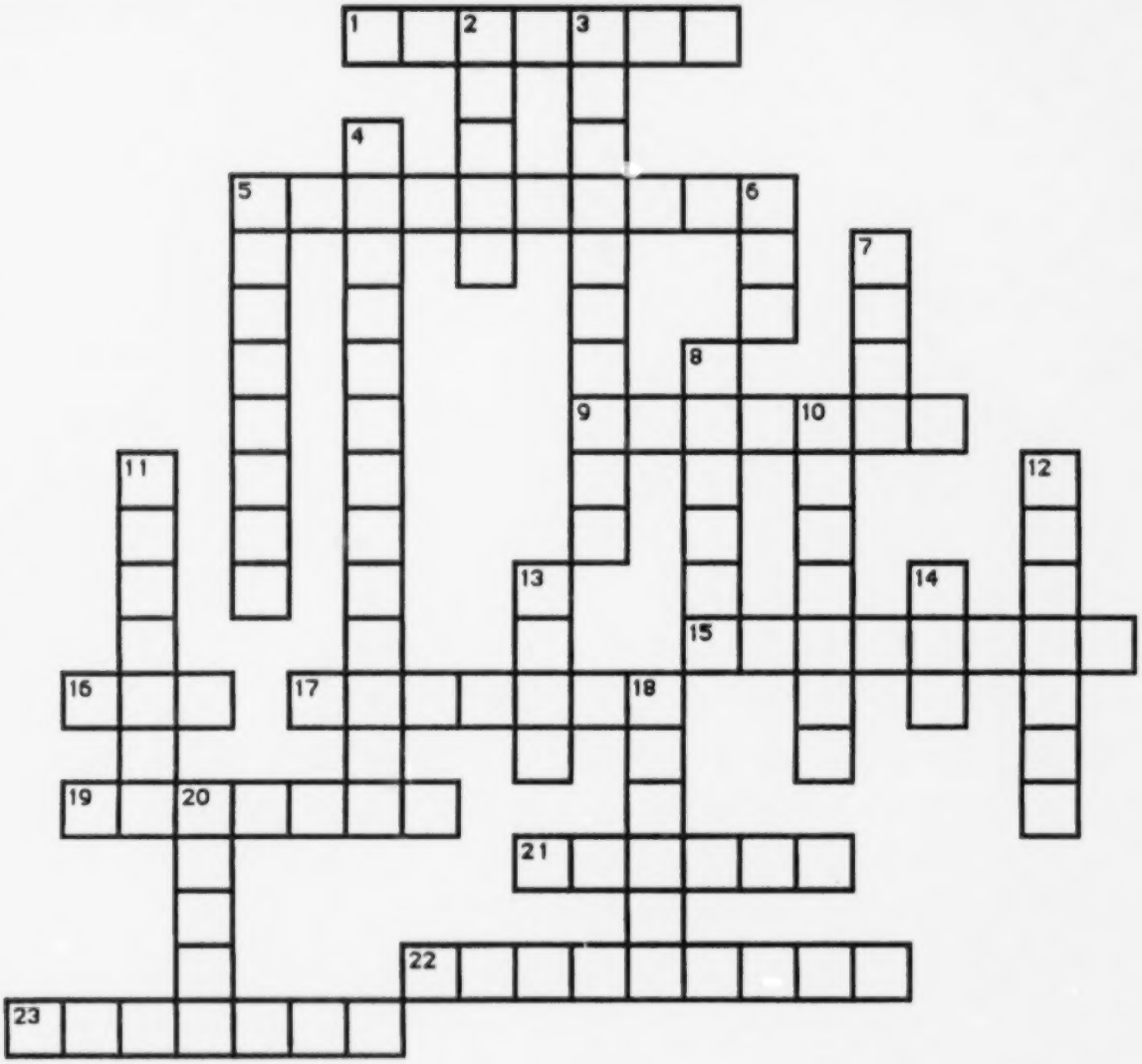
Environmental Crossword



Across

1. The total amount of life on Earth.
5. _____ Effect. Heats Earth.
9. The study of the relationship between man and nature.
15. Where garbage goes.
16. Cancer causing chemical.
17. Carbon _____.
19. A gas from rotting garbage.
21. When you burn something you get this.
22. Specific relationships among living things.
23. Types of life.

Down

2. Protects Earth from ultraviolet radiation.
3. A protective layer of air.
4. Cutting down forests.
5. A traffic jam.
6. Environmental Protection Agency.
7. Air pollution.
8. _____ fuel from dead plants.
10. Material that was once alive.
11. To use again.
12. A non-fossil fuel.
13. The living Earth.
14. Chlorofluorocarbon.
18. What makes things go. Power.
20. Poisonous.

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Vocabulary Quiz

1. _____ atmosphere
2. _____ biomass
3. _____ biosphere
4. _____ carbon dioxide
5. _____ chlorofluorocarbons
6. _____ deforestation
7. _____ desertification
8. _____ ecology
9. _____ ecosystem
10. _____ Environmental Protection Agency
11. _____ fossil fuel
12. _____ Gaia Hypothesis
13. _____ Greenhouse Effect
14. _____ gridlock
15. _____ landfill
16. _____ methane gas
17. _____ nuclear power
18. _____ organic
19. _____ ozone layer
20. _____ PCB's
21. _____ recycle
22. _____ species
23. _____ smog
24. _____ wastes
25. _____ toxic wastes

A. Describes the cutting down of the forests of Earth.

B. The total of life on Earth, both plants and animals.

C. The cause of the disapperance of the Ozone Layer.

D. Specific relationships among living things and the environment.

E. A study of the relationship between man and nature.

F. Traffic congestion caused by cars.

G. Describes the increasing size of deserts.

H. The heating of the Earth's atmosphere.

I. The idea that Earth is a living system.

J. Where garbage is buried.

K. The recovery and reusing of waste products.

L. Different types of life.

M. A form of air pollution produced by cars.

N. Rotting or deteriorating material that was alive.

O. In charge of protecting the environment.

P. A common toxic chemical that can pollute water.

Q. It protects the Earth from harmful rays of the sun.

R. A blend of carbon which is burned and oxygen.

S. A gas that is produced by rotting organic material.

T. What humans throw away after use .

U. The layer of air surrounding the Earth.

V. Power produced by radioactive elements.

W. The relationship of plants and animals to the atmosphere that surrounds Earth.

X. Wastes that are particularly poisonous to humans.

Y. Coal and oil which provide most of our energy.

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